



*Safety*

**TRAINING SYSTEMS FIRE PROTECTION**

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★The criteria in this standard are the Air Force's minimum safety, fire prevention, and occupational health requirements. Major commands (MAJCOM), direct reporting units (DRU), and field operating agencies (FOA) may supplement this standard when additional or more stringent safety, fire prevention, and health criteria are required. Refer to Air Force Instruction (AFI) 91-301 *Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Program* for instructions on processing supplements or variances. Report conflicts in guidance between this standard, federal standards, or other Air Force directives through MAJCOM, DRU, or FOA ground safety offices to Headquarters Air Force Safety Center, Safety Engineering and Standards Division (HQ AFSC/SEGS), 9700 G Avenue, SE, Kirtland AFB NM 87117-5670.

★This standard provides guidance on fire protection engineering criteria, fire prevention requirements, and housekeeping procedures for all training devices as addressed in Air Force Pamphlet (AFPAM) 36-2211 *Guide for Management of Air Force Training Systems*. Headquarters Air Force Civil Engineering Support Agency (HQ AFCEA) shall determine the fire prevention requirements for trainers other than those addressed in AFPAM 36-2211. Questions shall be directed to Headquarters Air Force Civil Engineering Support Agency (HQ AFCEA/CES), 139 Barnes Drive, Suite 1, Tyndall AFB FL 32403-5319.

★This standard applies to all US Air Force organizations, including US Air Force Reserve personnel and when Air National Guard personnel are on Federal Service.

★The use of illustrations in the standard is to aid in recognition of equipment only and does not imply endorsement by the Air Force.

**SUMMARY OF REVISIONS**

★Facility ultra-sensitive smoke detection is now required for new or relocated training systems [paragraph 3.2.3](#) ). An internal training device fire detection and alarm system is no longer required in areas protected by a facility ultra-sensitive smoke detection system [paragraph 4.2.2](#) . Ultra-sensitive smoke detection is permitted as part of the internal training device fire detection and alarm system when facility ultra-sensitive smoke detection is not provided ([paragraph 4.2.2.1.2](#) ). Existing halon systems are required to be placed on manual activation and their servicing following discharge is prohibited [paragraph 5.4](#) ). An ★ indicates revisions from previous edition of AFOSH Standard 127-118

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## ★Chapter 1

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### HAZARDS AND HUMAN FACTORS

1.1. Adequate fire protection for training systems is essential for continued mission accomplishment. Personnel who use training systems will be protected from conditions which could cause injury or death. Training systems are more valuable and critical to mission accomplishment than ever before and will be provided adequate protection.

1.2. Following are examples of hazards and human factors that could cause fire, injuries, or damage to equipment. Refer to Military Standard (Mil Std 1472, *Human Engineering Design Criteria for Military Systems, Equipment, and Facilities* for additional guidance.

- 1.2.1. Improper fire prevention practices;
- 1.2.2. Inadequate fire detection and (or) suppression systems;
- 1.2.3. Inadequately marked or blocked egress routes that prohibit escape in the event of a fire or emergency;
- 1.2.4. Accidental contact with energized electrical circuits that results in serious injury or electrocution if quick emergency action is not taken;
- 1.2.5. Poor housekeeping;
- 1.2.6. Operator error;
- 1.2.7. Faulty design; and
- 1.2.8. Lack of training.

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## ★Chapter 2

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### GENERAL REQUIREMENTS

**NOTE:** The requirements of this chapter apply to all training systems.

**2.1. Fire Extinguishers.** Portable 1A-10B:C (or greater) fire extinguishers shall be located according to National Fire Protection Association Standard (NFPA) 10, *Fire Extinguishers, Portable*, in all facility areas such as motion bays, model boards, visual display rooms, computer bays, etc. Additional fire extinguishers may be provided in cockpit and (or) other crew stations. Portable carbon dioxide (CO<sub>2</sub>) fire extinguishers with a minimum rating of 10B:C may be used in areas primarily devoted to delicate and costly electronic equipment.

**2.2. Procedures:**

2.2.1. A fire safety briefing will be provided to the pilots and (or) crew members at the start of each training session. This briefing will detail the signals used to indicate an emergency condition in the training system, specific actions required by the pilots and (or) crew members, and specific actions required by the instructor and (or) operators.

2.2.2. Prompt action during a fire event is the surest means to protect personnel while minimizing the resulting damage. These requirements envision a layered protection system. The first level of protection is to alert the operators and users for appropriate manual action. In many cases this would simply involve removing power from the problem area. The training system and (or) facility fire detection system provides the next level of protection and the facility suppression system the final level of protection.

2.2.3. Good housekeeping is an important element of mishap prevention in training system facilities.

2.2.3.1. Combustible materials shall be disposed of in suitable noncombustible containers, conspicuously labeled as to contents and with self-closing lids. These containers shall be emptied when full and at least at the end of each working shift. Consult with the installation environmental flight (CEV) or environmental management (EM) for determination and disposal of combustible hazardous waste.

2.2.3.2. Building floors, especially raised floors, shall be kept smooth, clean, and free of obstructions and slippery materials.

2.2.3.3. Floor loading capacities shall be posted according to [AFOSH Standard 91-22](#), *Walking Surfaces, Guarding Floor and Wall Openings and Holes, Fixed Industrial Stairs, and Portable and Fixed Ladders*. These capacities shall not be exceeded.

2.2.3.4. Floors shall not be cleaned with flammable or combustible liquids. Follow the manufacturer's guidelines when using cleaning agents for floors and facilities. In the absence of manufacturer's guidelines for the intended use, installation bioenvironmental engineering (BE) personnel shall be informed prior to using such chemicals. They will determine the degree of hazard associated with the use of the agent and prescribe the appropriate controls.

2.2.3.5. Appropriate housekeeping procedures shall be maintained at all times. Verification of removal of foreign objects from under raised floors will be accomplished every 180 days. Areas under raised floors shall not be used for storage. Openings in raised floors, including raised training platforms, for electrical cables or other uses shall be protected to preclude the collection of debris and to prevent tripping.

2.2.3.6. Utility trenches shall be kept clean of foreign objects. Inspection will be accomplished at least every 180 days.

2.2.3.7. Drip pans shall be used to prevent accumulation of hydraulic fluid on floor and (or) equipment surfaces. Drip pans will be cleaned whenever there is excessive buildup of fluids.

### ★Chapter 3

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## ***FACILITY REQUIREMENTS***

**3.1. Requirements.** The requirements of this chapter apply to all facilities housing training systems. Proper layout, spacing, and arrangement of equipment and machinery are essential and can best be achieved in the planning stages by considering current and future uses of the facility. The host installation ground safety, civil engineering (BCE), fire protection, and BE personnel shall coordinate on all plans.

**3.2. Location.** Training systems shall only be placed in facilities complying with Military Handbook (MIL HDBK) 1008B, *Fire Protection for Facilities Engineering, Design and Criteria*, and Engineering Technical Letter (ETL) 93-5, *Fire Protection Engineering Criteria - Electronic Equipment Installations*. Training systems shall be considered as mission support equipment as defined in ETL 93-5. The required installed facility protection shall include:

3.2.1. The entire facility (including equipment and non-equipment spaces) will be completely protected by an automatic sprinkler system installed according to NFPA 13, *Installation of Sprinkler Systems*, and maintained according to requirements in Air Force Joint Manual (AFJMAN) 32-1048, *Maintenance of Fire Protection Systems*.

3.2.2. Training system spaces will be separated from other spaces and (or) occupancies and operationally distinct adjacent equipment spaces in the facility by a minimum of 1-hour fire rated construction. The 1-hour rated construction will extend from structural floor to structural ceiling and (or) roof.

3.2.3. Training system spaces will be provided with a smoke detection system. Spaces containing flight training devices or high value training devices will be provided with ultra-sensitive smoke detection systems, according to EPL 93-5. Existing facilities housing training devices with internal fire detection and alarm systems complying with [paragraph 4.2.2.1](#), do not require ultra-sensitive detection.

3.2.4. Raised floor spaces will be divided in the same manner as the equipment spaces above the area they serve.

3.2.5. Raised floor spaces will be provided with a standard or ultra-sensitive smoke detection system in the same manner as the equipment spaces above the area they serve.

3.2.6. Raised floor systems will be constructed of noncombustible materials.

3.2.7. If the training system spaces are served by air handling equipment which also serves any other part of the facility, including an adjacent training system space, automatic smoke and fire dampers shall be provided to shut off the space from the remainder of the facility upon any facility fire alarm indication. The air handling system shall contain provisions to shut down upon activation of the facility fire detection system. Air handling systems which exclusively serve the individual training system space do not have to be deactivated upon facility fire alarm indications except for conditions originating in the training system space.

### **3.3. Electrical:**

3.3.1. **Surge Protection.** Surge protection shall be provided for all incoming power to the training system. New facilities constructed to house training systems should be provided surge protection for the entire facility.

#### **3.3.2. Cable and Wiring:**

3.3.2.1. Communications and interconnecting cable and wiring between components within the training system space and raised floor space will comply with NFPA 70, *National Electrical Code*, Article 645.

3.3.2.2. Communications and interconnecting cable and wiring between components in the training system space and other areas of the facility or other facilities will comply with NFPA 70, Article 725.

3.3.2.3. All power and distribution circuits shall comply with the appropriate NFPA 70 Article and AFJMAN 32-1081, *Electrical Design, Interior Electrical Systems*.

**3.4. Drainage.** Drainage shall be provided in the utility trenches and in the motion bays.

**3.5. Hydraulic Pump Room.** Hydraulic pump rooms shall be of 1-hour construction, except rooms which contain more than 250 gallons of hydraulic fluid which shall be of 2-hour construction.

3.6. **Emergency Lighting.** Emergency lighting will be provided according to requirements in ETL 94-5, *Fire Protection Engineering Criteria - Emergency Lighting and Marking of Exits*.

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★Chapter 4

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## **TRAINING SYSTEMS REQUIREMENTS**

**4.1. Requirements.** The requirements of this chapter apply to all training systems beginning design or development after the effective date of this standard.

**4.2. General:**

4.2.1. Only fire resistant and non-hazardous (when exposed to fire) materials shall be used in cockpits, seats, shrouds, cable ties, cable coverings, auxiliary insulations (such as heat, electrical, sound, etc.). Flame spread shall not exceed a rating of 75 and smoke development shall not exceed a rating of 100 when tested according to ASTM E-84, *Standard Method of Test of Surface Burning Characteristics of Building Materials*. Aircraft components not meeting this requirement may only be used when the application is in an identical configuration and material between training device and actual system.

4.2.2. Fire detection and alarm systems are not required internally in new or modified training devices.

4.2.2.1. Existing flight or high value training systems located in spaces not protected by ultra-sensitive smoke detection, according to [paragraph 3.2.3.](#), shall have an internal fire detection and alarm system. This system shall interconnect all direction and annunciation devices with the various training system components (cabinets, instructor operator station [IOS], cockpit, motion base, etc.).

4.2.2.1.1. Dual fixed temperature-type fire detectors shall be installed in electrical, electronic, hydraulic, and computer cabinets. Activation of the first detector (i.e. the one calibrated to the lower activating temperature) shall be announced with a distinctive audible signal. If this equipment is located in an unoccupied area (i.e. computer rooms), a means shall be provided to positively alert the operators at the IOS. If multiple unoccupied computer areas are present, then a means shall be provided to inform the IOS which unoccupied area has the activated alarm. Activation of the second detector (i.e. the one calibrated to the higher activating temperature) shall activate the facility detection system through the training system fire alarm panel, which, in turn shall deenergize the simulator and all peripheral equipment.

4.2.2.1.2. Ultra-sensitive smoke detection systems shall be provided to protect electrical, electronic, and computer cabinets. A minimum two-stage warning capability shall be provided. The first, most sensitive stage shall be announced with a distinctive audible signal. If the equipment is located in an unoccupied area (i. e., computer room), a means shall be provided to positively alert the operators at the IOS. If multiple unoccupied computer areas are present, then a means shall be provided to inform the IOS which unoccupied area has the activated alarm. Activation of the second, less sensitive stage shall activate the facility detection system through the training system fire alarm panel, which, in turn shall deenergize the simulator and all peripheral equipment.

4.2.2.2. A graphic fire alarm annunciator panel and transmitter, conforming to NFPA 72, *National Fire Alarm Code*, shall be installed. This panel shall identify signals from the training system fire detection systems. Each detection device shall be identified by light emitting diodes in the graphic annunciator panel.

4.2.2.3. The system fire detection and alarm control panel shall be designed to transmit both coded fire and trouble signals (NFPA 72) to the fire alarm and receiving center or other monitoring service (when not located on a department of defense [DoD] installation). This may be through the facility fire alarm transmitter or an independent fire alarm transmitter. Transmitter type and requirements are dependent upon the fire alarm and receiving equipment installed on each base, therefore requirements will be locally supplied.

4.2.2.4. Activation of the facility fire suppression system shall cause shutdown of the training system power source. These shutdowns are in addition to any shutdowns caused by the training system fire detection system.

4.2.2.5. A dedicated circuit with backup battery power shall power the fire detection system. Connection to the facility electrical supply shall be ahead of the training system disconnect switch

4.2.2.6. The fire detection system shall be capable of operating from both 50 and 60 Hertz.

4.2.3. Fire stops shall be provided every 25 feet in all cable trays, utility trenches, etc., that connect to space outside the training system spaces.

4.2.4. If the training systems are served by air handling equipment which also serve any other part of the facility including an adjacent training system space, automatic smoke and fire dampers shall be provided to shut off the space from the remainder of the facility upon any facility fire alarm indication. Air handling systems which exclusively serve the individual training system do not have to be deactivated upon facility fire alarm indications except for conditions originating within the training system.

4.2.5. Specifications for cable and wiring follow:

4.2.5.1. Polyvinyl chloride (PVC) coated wire shall not be used in the cockpit areas of the training system. Plenum rated cable and wiring should be used.

4.2.5.2. Communications and interconnecting cable and wiring between components within the training system space and raised floor space will comply with NFPA 70, Article 645.

4.2.5.3. Communications and interconnecting cable and wiring between components in the training system space and other areas of the facility or other facilities will comply with NFPA 70, Article 725.

4.2.5.4. Power and signal cable groups in which heat cannot quickly be dissipated may contain a heat sensor wire

4.2.5.5. Cable and wiring for the training system fire alarm system will comply with NFPA 70, Article 760.

4.2.6. Emergency lighting shall be provided in all enclosed occupied training spaces. The emergency lighting system will comply with NFPA 70, Article 700.

4.2.7. A means to disconnect electrical power to the entire training system shall be provided at all IOS and at other key locations on the training system.

#### ***4.3. Computer and (or) Electronic Cabinets:***

4.3.1. Self-contained air conditioning systems shall contain a product of combustion detector. Activation of this detector shall sound an audible alarm and activate the facility detection system.

4.3.2. Cabinets in the vicinity of a motion base water fog and (or) spray deluge system should be water resistant and (or) shielded from water discharge. Cabinets in the vicinity of a motion base wet pipe sprinkler system (paragraph 4.6.6.) do not require special protection.

4.3.3. The acquiring authority may exempt "off-the-shelf" computer and (or) electronic devices with internal thermally activated power disconnects from the requirements for dual fixed temperature-type thermal fire detectors for computer and (or) electronic cabinets.

#### ***4.4. Instructor Operator Station (IOS):***

4.4.1. A means to activate the facility fire detection system shall be provided in easy reach of the operators at the IOS. Normally a standard manual fire alarm station will be provided on the operator's console with provision to be interconnected to the facility alarm and detection system.

4.4.2. Smoke detection devices shall be provided in the IOS when located in an enclosed container and (or) space not part of the facility. Activation of this system shall alert the training system occupants and the operators at the IOS.

4.4.3. When the IOS is located in an enclosed container and (or) space not part of the facility, a facility alarm annunciator shall be installed.

#### ***4.5. Cockpit and (or) Other Crew Stations:***

4.5.1. Single station smoke detection devices shall be provided in the cockpit and other enclosed crew stations. Battery powered detector shall not be used.

4.5.2. The cockpit shall be designed to preclude or restrict passage of smoke and gases through the cockpit floor or sides.

4.5.3. A means shall be provided to alert cockpit and (or) other crew station occupants of a positive activation of the local and facility detection systems.

4.5.4. Training station ventilation shall be shutdown if the training system fire detection is activated.

#### ***4.6. Motion Base:***

4.6.1. Upon activation of either the system fire detection system or the facility fire suppression system, the motion system shall return it to the rest position within 10 seconds. Access ramps shall automatically deploy after motion is stopped, even when power is removed.

4.6.2. Hydraulically powered motion bases shall comply with the following:

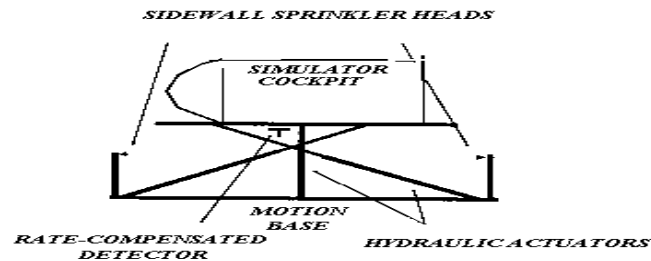
4.6.2.1. Hydraulic pump controls will be designed so operation of either the facility fire alarm system or the training system fire alarm system causes the pumps to shut down.

4.6.2.2. Hydraulic pump controls will be designed to automatically shut down upon sudden or excessive flow in the hydraulic lines, when the fluid level is low, or when excessive hydraulic fluid temperature is sensed.

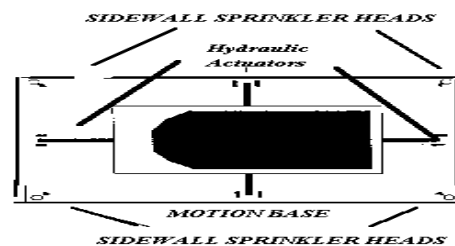
4.6.2.3. Flexible hoses shall be shielded to prevent any leaking hydraulic fluid from spraying on potential ignition sources.

4.6.2.4. Rate-compensated type thermal fire detection devices shall be provided under the motion platform (figure 4-1).

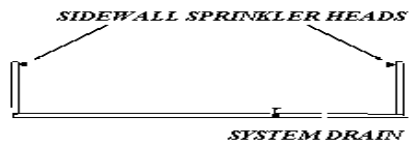
4.6.2.5. A wet pipe sprinkler system (sprinkler heads and piping) shall be provided as part of the motion base (figures 4-1 through 4-4). The exact position for each sprinkler location and number of sprinklers will be individually defined for each motion base to ensure complete coverage and to prevent interference with the range of motion for each hydraulic actuator. The system shall be designed to deliver a minimum of 0.35 gallons per minute per square foot to the area under the motion base. Normally the piping would be interconnected to the facility sprinkler system, but a separate system riser is acceptable.



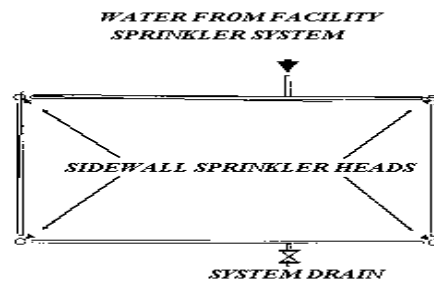
*Figure 4-1. Motion Base (Side View).*



*Figure 4-2. Motion Base (Top View).*



*Figure 4-3. Sprinkler System Piping (Side View)*



*Figure 4-4. Sprinkler System Piping (Top View).*



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## ★Chapter 5

### ***EXISTING FACILITIES AND TRAINING SYSTEMS***

**NOTE:** Existing facilities and training systems may continue in use while awaiting upgrade to comply with [paragraphs 3.1.](#) and [4.1.](#), if they comply with all the following:

**5.1. Facilities.** No fire safety deficiencies (FSDs) of severity category I or II are currently outstanding.

**5.2. Training Systems.** It is assumed existing training system deficiencies either have been upgraded or are currently programmed to be upgraded to comply with previous editions of this standard. Training systems currently identified to be upgraded to previous editions of this standard, may be upgraded as programmed provided Halon 1301 or other gaseous agent was not part of the upgrade.

**5.3. Maintenance.** All currently installed fire protection features shall be regularly serviced and maintained in operational condition.

**5.4. Halon.** Existing halon fire suppression systems shall be placed on manual activation. Automatic discharge mechanisms shall be disabled. Existing halon fire suppression systems will not be reserviced following discharge and the training device shall remain operational. Training systems developed with halon fire suppression systems shall transition to these standards during any major modification.

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